

CLAIMS

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What is claimed is:

1. A magnetic field sensor comprising magnetostrictive material and piezoelectric material.

5 2. A magnetic field sensor comprising about one layer of magnetostrictive material that strains under the influence of a magnetic field and imparts stress to about one layer of piezoelectric material to produce a detectable voltage.

10 3. A magnetic field sensor as described in Claim 2, wherein the sensor consists essentially of two layers of magnetostrictive material sandwiching one layer of piezoelectric material.

4. A magnetic field sensor as described in Claim 2, wherein the sensor consists essentially of two layers of piezoelectric material sandwiching one layer of magnetostrictive material.

15 5. A magnetic field sensor as described in Claim 2, wherein a sensitivity of the sensor is proportional to a thickness of the piezoelectric layer and substantially independent of an area of the sensor when a high impedance readout circuit is used.

20 6. A magnetic field sensor comprising at least one layer of magnetostrictive material that strains under the influence of a magnetic field and imparts stress to at least one layer of piezoelectric material to produce a detectable voltage, wherein the sensor is supported as a cantilever in which one end of the sensor is allowed to strain freely to thereby increase the sensitivity.

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7. A magnetic field sensor comprising at least one layer of magnetostrictive material that strains under the influence of a magnetic field and imparts stress to at least one layer of piezoelectric material to produce a detectable voltage, wherein the magnetostrictive material forms a substrate.

- 5 8. A magnetic field sensor as described in Claim 7, wherein the magnetostrictive material is a ferrite.

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9. A magnetic field sensor comprising a substrate of magnetostrictive material that strains under the influence of a magnetic field and imparts stress to at least one patterned stripe of electrically insulating piezoelectric material to produce detectable voltage.
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10. A magnetic field sensor as described in Claim 9, wherein the magnetostrictive material is a ferrite.

11. A magnetic field sensor as described in Claim 9, wherein the magnetostrictive material is a metal.
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12. A magnetic field sensor as described in Claim 10, further comprising multiple, series connected stripes of piezoelectric material.

13. A magnetic field sensor comprising magnetostrictive material matrix strains under the influence of a magnetic field and imparts stress to at least one piezoelectric material rod or fiber surrounded by the matrix to produce a detectable voltage.
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14. A magnetic field sensor comprising at least one magnetostrictive material rod or fiber that strains under the influence of a magnetic field and imparts stress to the surrounded piezoelectric material matrix to produce a detectable voltage.

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15. A read head comprising a magnetostrictive material that strains under the influence of a magnetic field and imparts stress to a piezoelectric material to produce a detectable voltage.

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16. A magnetic random access memory device comprising an array of element cells, each of which comprises a structure including at least one piezoelectric layer and at least one magnetostrictive layer, wherein a word line and a sense line connect to the element cells.

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17. An electromagnetic field sensor comprising about one layer of magnetostrictive material that strains under the influence of a magnetic field and imparts stress to about one layer of piezoelectric material to produce a detectable voltage.

18. A magnetic field sensor array, comprising: a one dimensional array of magnetic field sensors, each field sensor comprising layers of magnetostrictive and piezoelectric material; and a read-out circuit for detecting a response of each one of the magnetic field sensors. *what a how*

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19. A magnetic field sensor array, comprising: a multi-dimensional array of magnetic field sensors, each field sensor comprising layers of magnetostrictive and piezoelectric material; and a read-out circuit for detecting a response of each one of the magnetic field sensors.

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How?

20. A motion speed detection system, comprising a magnetic wheel mounted on a shaft of motor; and a sensor located near to the magnetic wheel comprising a magnetostrictive material that strains under the influence of a changing magnetic field induced by rotation of the magnetic wheel, the magnetostrictive material imparting stress to a piezoelectric material to produce a detectable voltage that is a sine wave form and its frequency is indicative of rotation speed of the motor.

21. A magnetic wheel as described in Claim 20 is a ferromagnetic rotor (gear).
22. A magnetic wheel as described in Claim 20 is a nonmagnetic rotor with magnets mounted on the edge in an equal spacing, which will generate a sine wave of magnetic field as it rotates.
23. A fluid flow detection system, comprising a magnetic wheel located in a fluid flow path; and a sensor located near the magnetic wheel comprising a magnetostrictive material that strains under the influence of a changing magnetic field induced by rotation of the magnetic wheel, the magnetostrictive material imparting stress to a piezoelectric material to produce a detectable voltage that is a sine wave form and its frequency is indicative of the fluid flow rate.
24. A magnetic wheel as described in Claim 23 is a ferromagnetic rotor consisting turbine pedals or blades, which will generate a sine wave of magnetic field as it rotates.
25. A magnetic wheel as described in Claim 23 is a nonmagnetic rotor with magnets mounted on each pedals or blades, which will generate a sine wave of magnetic field as it rotates.
26. A system as described in Claim 23, wherein the fluid is a liquid.
27. A system as described in Claim 23, wherein the fluid is a gas.

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28. A electrical current detecting system, comprising a sensor located near to a electrical current wire comprising magnetostrictive material that strains under the influence of a magnetic field induced by electrical current and imparts stress to piezoelectric material to produce a detectable voltage that has the same wave form as that of the detecting current and its amplitude is proportional to the amplitude of detecting current.
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29. A system described in Claim 28, comprising permanent magnets near to the sensor to produce bias magnetic field.

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